FINAL REPORT: NASA GRANT NAGW-666

X-Ray and Gamma Ray Emission from Accreting, Magnetized Neutron Stars

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During the total duration of this grant, which was first awarded to the PI in the early 1980's, a variety of projects have been carried out. Among the topics studied with the partial support of NASA grant NAGW-666 have been:

•Coulomb deceleration of accreting protons in the atmosphere of a strongly magnetized neutron star.

•Cyclotron line radiative transfer in accreting, magnetized neutron stars.

•Cyclotron line radiative transfer in gamma ray bursts.

•Nuclear gamma ray line production in accretion onto neutron stars.

•Atomic, molecular and solid state physics in strong magnetic fields characteristic of the surfaces of neutron stars.

A small number of representative reprints are attached, and a list of publications partially supported by this grant during the past four years only follows.

Publications Supported by this Grant in 1991-1995

1. "The Fate of CNO Elements in Neutron Star Atmospheres: X-Ray Bursts and Gamma-Ray Lines," L. Bildsten, E.E. Salpeter and I. Wasserman, Ap. J, 384, 143, 1992.

2. "Statistics of Gamma Ray Bursts: Homogeneous Spherical Models," I. Wasserman, Ap. J., 394, 565, 1992.

3. "Nonthermal X-ray Emission from Magnetic Neutron Stars Accreting from the Interstellar Medium," R.W. Nelson, E.E. Salpeter and I. Wasserman, to appear in *Proceedings for Conference on the Physics of Isolated Neutron Stars*(Taos, NM, February, 1992), eds. K.A. Van Riper, R.I. Epstein and C. Ho (Cambridge: Cambridge University Press).

4. "The Rotation Curve Conspiracy and Neutron Star/Asteroid Models for Gamma Ray Bursts," E.E. Salpeter and I. Wasserman, in *Planets Around Pulsars*, eds. J.A. Phillips,

S.E. Thorsett and S.R. Kulkarni (San Francisco: Astronomical Society of the Pacific).

5. "Nonthermal Cyclotron Emission from Low Luminosity Accretion onto Magnetic Neutron Stars," R.W. Nelson, E.E. Salpeter and I. Wasserman, Ap. J., 481, 874, 1993.

6. "Helium Destruction and Gamma Ray Line Emission in Accreting Neutron Stars," L. Bildsten, E. E. Salpeter and I. Wasserman, Ap. J., 408, 615, 1993.

7. "A Semi-Analytic Model for Cyclotron Line Formation," J.C.L. Wang, I. Wasserman and D.Q. Lamb, Ap. J., 414, 815, 1993.

8. "Baryonic Dark Clusters in Galaxy Halos and Their Observable Consequences," I. Wasserman and E.E. Salpeter, Ap. J., 433, 670, 1994.

9. "Signal Detection Amidst Noise with Known Statistics," A.F. Zepka, J.M. Cordes and I. Wasserman, Ap. J., 427, 438, 1994.

10. "Inferring the Spatial and Energy Distribution of Gamma Ray Burst Sources. I. Methodology," T.J. Loredo and I. Wasserman, Ap. J. Supp., 96, 261, 1995.

11. "A Possible Cyclotron Line Signature From Quiescent Gamma-Ray Burst Counterparts," J.C.L. Wang and R.W. Nelson, in *Proceedings of the Second Huntsville Gamma Ray Burst Workshop*, eds. G.J. Fishman, K. Hurley and J.J. Brainerd (New York: AIP), in press.

12. "Four New Radio Pulsars from High-Energy Selected Targets," A. Zepka, J.M. Cordes, S.C. Lundgren, and I. Wasserman, in *Soft X-Ray Cosmos: Proceedings of the ROSAT Science Symposium*, eds. E.M. Schlegel and R. Petre (New York: AIP), in press.

13. "Discovery of 3 Radio Pulsars From a Search Targeted at X-Ray Sources," A. Zepka, J.M. Cordes, S.C. Lundgren, and I. Wasserman, in *Proceedings of the Aspen Winter Astrophysics Conference on Millisecond Pulsars: A Decade of Surprises*, January 1994.

14. "Hydrogen Molecules and Chains in a Superstrong Magnetic Field," D. Lai, E.E. Salpeter and S.L. Shapiro, Phys. Rev. A, 45, 4832, 1992.

15. "The Promise of Bayesian Inference for Astrophysics (with Discussion)", T.J. Loredo, in *Statistical Challenges in Modern Astronomy*, ed. E.D. Feigelson and G.J. Babu (New York: Springer-Verlag) pp. 275–297 (1992).

16. "A New Method for the Detection of a Periodic Signal of Unknown Shape and Period," P.C. Gregory and T.J. Loredo), Ap. J., 398, 146, 1992.

17. "A Bayesian Method for the Detection of a Periodic Signal of Unknown Shape and Period," P.C. Gregory and T.J. Loredo, in *Maximum Entropy and Bayesian Methods, Seattle, 1991*, ed. C.R. Smith, G.J. Erickson and P.O. Neudorfer (Dordrecht, The Netherlands: Kluwer Academic Publishers), 79, 1992.

18. "A Bayesian Method for the Detection of a Unknown Periodic and Nonperiodic Signals in Binned Time Series," P.C. Gregory and T.J. Loredo, in *Maximum Entropy and Bayesian Methods, Paris, France, 1992*, ed. A. Mohammad-Djafari and G. Demoment (Dordrecht, The Netherlands: Kluwer Academic Publishers), 225, 1993.

19. "Establishing the Existence of Lines in γ-Ray Bursts," T.J. Loredo and D.Q. Lamb, in *Gamma-Ray Bursts, Huntsville, AL 1991*, ed. W.S. Paciesas and G.J. Fishman (New York: American Institute of Physics), pp. 414, 1992.

20. "Inferring the Spatial and Energy Distribution of Burst Sources From Peak Count Rate Data," T.J. Loredo and I. Wasserman, in *Compton Gamma Ray Observatory, St. Lous, MO 1992*, ed. M. Friedlander, N. Gehrels, and D.J. Macomb (New York: American Institute of Physics), pp. 749, 1993.

21. "A Potential Cyclotron Line Signature in Low Luminosity X-Ray Sources," R.W. Nelson, J.C.L. Wang, E.E. Salpeter, and I. Wasserman, Ap. J. Lett., 438, L99, 1995.

22. "Discovery of Three Radio Pulsars from an X-Ray Selected Sample," A. Zepka, J.M. Cordes, I. Wasserman and S.C. Lundgren, Ap. J., in press, 1995.